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AEROMEDICAL EVACUATION: CLINICALLY PREPARING AIR FORCE FLIGHT NURSES

by

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PREFACE

Aeromedical evacuation is a vital capability. It is also fulfilling to personnel contributing to the mission. Medical crews care for sick and wounded servicemen worldwide. Those in need of medical care are transported to hospitals capable of treating each patient's malady. Flight nurses ensure patients receive safe transport and are treated with dignity. For military members required to engage in life-threatening situations, understanding that the Air Force will spare no expense to expediently return them home, if injured, provides them with hope and confidence.

I am fortunate to have served as a military flight nurse. Providing care for patients leaving Afghanistan has been a highlight in my career. I have also had the privilege to return many patients home to the United States. Although I am honored to have served in this capacity, I am also concerned with the limited opportunities for flight nurses to maintain their clinical proficiency.

Prior to my aeromedical evacuation assignment, I was stationed at the Air Force's premiere trauma center. While working in the emergency department I was constantly challenged. My medical knowledge grew daily, and there was no shortage of opportunities to perform clinical interventions and interact with patients. This is not the case for those assigned to an aeromedical evacuation squadron. This contrast led me to question flight nurse proficiency.

Flight nurses are charged with caring for patients with diverse healthcare needs. While in flight they are isolated from the plethora of resources found in a hospital. For these reasons it is important to ensure flight nurses are clinically prepared.

Researching this topic has been personally satisfying, and I hope it will prove to be beneficial. I would not have been able to complete this project without the guidance of Dr. Patricia Lessane and Dr. Marcia Ledlow. I am especially indebted to my wife, who provided me with unmeasurable support and encouragement.

ABSTRACT

The Air Force's aeromedical evacuation capability is a lifesaving asset. It is unique from civilian air ambulance services because the Air Force transports battle injured patients directly out of military theaters. War can result in the evacuation of many patients on a single aircraft. These patients can have a variety of diseases and injuries. Many combat related injuries are severe and complex. Nurses are often the mostly highly educated medical personnel aboard these missions. This makes them solely responsible for life-saving decisions and interventions. The burden of this responsibility should only be borne by flight nurses capable of, and willing to, achieve the highest qualifications.

Unfortunately, this is not the case. The Air Force currently fails to hold military flight nurses to the same standards as commercial employers. Professional flight nursing standards are set by The Air & Surface Transport Nurses Association. Divergent sets of standards raise questions related to safety and ethics. Upon assignment to an aeromedical evacuation squadron, military flight nurses have limited opportunities to maintain their clinical skills. This results in attempting to maintain proficiency primarily through simulation, a technique with unproven efficacy.

This research utilized the Problem/Solution framework, and sought to analyze the capability's history, operational structure, and training platform to identify possible alternatives that would better guarantee proficiency. This study produced three feasible alternatives. Each was evaluated by pertinent measures to provide a recommendation for the ideal method to improve the clinical skills of military flight nurses.

INTRODUCTION

A lack of registered nurses has plagued the nursing profession for years. This trend is not projected to improve. The Bureau of Labor and Statistics maintain a table entitled, "Occupations with the largest projected number of job openings due to growth and replacement needs, 2012 and projected 2022."[1] Registered nurses are near the top of the list. With the exception of construction laborers, all five of the occupations with bleaker projections are among the health professions. Job openings for registered nurses are projected to increase by 19.4 percent by 2022. Employers will also be struggling to fill 1,052.6 vacant nursing positions resulting from growth and replacement requirements.[2]

The American Nursing Association attributes this shortage to several trends. The professional nursing organization cites the increasing age of nurses, an aging population, and healthcare reforms that provide greater access to care.[3] An increased average age among nurses suggests that new nurses are not entering the profession, or younger nurses are leaving the profession. Regardless of the cause, it is clear that more people will require medical care in the near future, and nurses will not be available.

These trends make nurses a valuable commodity. They also have direct implications for the Air Force. Competition among employers will certainly increase, and the military recruiter's job will become increasingly difficult. The Air Force will be forced to find creative ways to attract employees. Inflating salaries will not be a viable option if the economy continues to falter. An unprecedented debt of $19.5 trillion, looming threats of sequestration, and competing budgetary priorities have already impacted military operations.[4]

The Air Force's best option to attract nurses is by cultivating a reputation of excellence. Excellence in nursing should imply superior opportunities for professional development. This involves competitive pay and opportunities for promotions, but also includes the provision of a

rich clinical environment, meeting standards set by professional organizations, and establishing new standards derived from evidence based research.

Flight nursing is an elite specialty. It requires competence that comes from experience, and it is a valued Air Force capability. The Air Force is responsible for transporting sick and wounded military members out of deployed locations. Caring for battlefield injuries during flight makes flight nurses unique. Nurses and technicians comprise the medical crew on most missions. Physicians are only added to missions when patients require advanced monitoring. This results in nurses often being the crewmembers with the highest qualifications. This duty provides the nursing profession with an opportunity to establish the Air Force as the premier aeromedical evacuation (AE) authority. Because of its importance, this paper will use the Problem/Solution framework to explore what changes can be made to improve the clinical proficiency of flight nurses and ensure competence in all aspects of patient care.

This paper analyzes the AE system. It begins by examining its inception and history. This provides insight on the development of AE structure and culture. An analysis of the present organization, flight nursing assignment eligibility, and training methods will provide a baseline understanding of the system. AE can then be compared to civilian transport practices and professional nursing organization standards. According to Major General David A. Rubenstein, the Commanding General of the United States Army Medical Department Center and School, this comparison is warranted. He believes, “A physician's assistant, a nurse, an emergency room technician, a laboratory technician, a hospital administrator - each of these roles is the same whether performed in a military uniform or a civilian suit.”[5]

This data will illuminate areas for improvement. Feasible solutions will be discussed. All solutions will be measured against criteria to ensure efficient and effective change. Criteria

will evaluate clinical practice opportunities, the impact on current operations, and cost considerations. Recommendations will be offered following analysis. A background that presents the history of AE and discusses operational aspects of the capability will provide context and develop an understanding of the current system.

BACKGROUND

The discovery of flight changed the world. It changed the military, and it changed the practice of medicine. Innovators envisioned transporting sick and injured patients by air. The United States military made this vision a reality. Using aircraft to transport patients became an airlift capability that is now an Air Force responsibility. The current aeromedical evacuation squadron (AES) is similar to its original structure. Nurses assigned to AE must accomplish training on operational components of the mission in addition to clinical training requirements.

The Genesis of AE

Captain George H. R. Gosman and Lieutenant Albert L. Rhoades were two of the first innovators to envision aircraft transporting wounded military members. Captain Gosman was a member of the United States Medical Corps and Lieutenant Rhoades was assigned to the Coast Artillery Corps.[6] The two men developed an air ambulance prototype in 1910. Their plane made a successful flight, but failed mechanically and crashed. A lack of funds prevented repairs, so the inventors petitioned the War Department for aid. Officials failed to see the air ambulance vision, and efforts to evacuate patients by air temporarily ceased.[7]

The vision resurfaced in 1918 as a result of crashes during pilot training exercises. Flight training officer, Captain William C. Ocker, recognized the need for rapid access to medical care following crashes. Collaboration with Major Wilson E. Driver, a reserve medical officer, produced the next air ambulance by modifying a Curtiss JN-4. A physician was flown to the

crash site to administer care. The patient would be secured in the modified passenger compartment and would replace the physician on the return fight. Successful patient evacuations led to the production of additional ambulances and modifications to other aircraft models.[8]

Figure 1 Curtiss JN-4 Used as an Air Ambulance. *Reprinted from Skaarup, Harold A. "Canadian Warbirds 2: The Biplane Era, Trainers, Transports and Utility Aircraft." Military History Books. Accessed 18 October 2016. http://silverhawkauthor.com/canadian-warbirds-2-the-biplane-era-trainers-transports-and-utility-aircraft-book_309.html.*

Advancements in technology eventually allowed a medical officer to accompany a patient during flight. A modified DH-4A allowed two litter patients to be attended by a physician. Simultaneously, a second air ambulance was under development. The goal was to accommodate patient transport in an aircraft cabin. Previous modifications enabled a rigid litter to be secured to the fuselage. Success was achieved by modifying a Curtiss Eagle. The Curtiss

Eagle allowed one physician to care for four litter patients or six ambulatory patients.[9] With these aircraft, the military was capable of long-range and crash-rescue transports.

With air ambulance acceptance, advocates lobbied for dedicated airframes that did not require modifications prior to flight. Interest was garnered, but funds were not. "Major General James E. Fechet, Chief of Air Corps in 1930, agreed that transports would constitute the basis for ambulance aircraft and he directed materiel and medical officers to work out suitable installations for converting standard transports to air evacuation purposes."[10] This decision stalled development of a crash-rescue capability until the advent of the helicopter. It also led to a reliance on mobility aircraft, which forced AE to compete with other airlift requirements. The expertise required to configure cargo planes to air ambulances contributed to an operationally focused career field.

An Operationally Focused AES

AE's relationship with airlift was further cemented in 1941. Following the Surgeon General of the Army's recommendation, the War Department approved the Medical Air Ambulance Squadron. "The squadron was to be a companion unit for an Air Corps Transport Group, which would possess one squadron of light aircraft and two squadrons of twin-engine transports."[11] The creation of this squadron had no provisions for dedicated medical personnel. It only ensured dedicated aircraft.

With an Evacuation Officer appointed to the Air Surgeon's office, the decision to appoint dedicated AE personnel was made. Medical flight crews were formed, and the Medical Air Evacuation Transport Squadron was established in 1943.[12] The squadron composed four flights and a headquarters. Each flight was led by a flight surgeon, and "consisted of six flight nurses, six enlisted surgical technicians, and two enlisted clerks."[13] AE missions were to be crewed by

one nurse and one technician. In 1944 the organization was renamed the Medical Air Evacuation Squadron.[14] Today it labeled the AES.

WWII resulted in many AE developments. Crewmembers served in the Pacific, Atlantic, and the continental United States. Ground ambulances supporting returning hospital ships were quickly overwhelmed. Air Transport Command and I Troop Carrier Command provided sorties to distribute patients.[15] The value of AE was cemented, and a peacetime mission was accepted. However, airlift was a scarce resource. "The first official Air Force basic doctrine manual, in 1953, did not even mention airlift."[16] Among airlift capabilities, the AES was forced to compete with "airdrop of men and equipment for airborne assault, airdrop/airland for resupply, [and] logistic transportation."[17]

With the creation of an independent Air Force in 1947, Military Air Transport Service assumed the AE capability. On 1 January 1966 Military Air Transport Service would be discontinued and Military Airlift Command would be activated. Military Airlift Command would be replaced by present day Air Mobility Command on 1 June 1992.[18] AE was conceptualized as more of an airlift capability than a medical capability with each successive command. This view destined the AES to remain attached to an airlift organization.

Plagued by modest resources and limited opportunities, the medical corps lost interest in AE. During WWII, "Very few of the air evacuation surgeon's duties were actually those of a medical doctor. According to one veteran doctor in the service, older medical doctors selected for this work encountered a morale problem for they were unable to keep up with normal developments in the medical and surgical profession."[19] This loss of interest led to the medical corps' departure. "Medical service corps officers replaced medical officers in command of aeromedical evacuation squadrons."[20] With this departure AE lost a powerful advocate.

"Aeromedical airlift became principally an operational concern and drew reduced medical interest."[21]

Current AES Structure

The current AES is similar to its original form. The squadron remains composed of four flights. Air Force Instruction (AFI) 38-101 directs this structure. This AFI applies to Air Force Reserve Command, Air National Guard, and active duty squadrons. Personnel primarily possess one of four Air Force specialty codes. These career field designators include: 46FX (Flight Nurse), 41AX (Health Services Administrator), 4N0XX (Aerospace Medical Service), 4A0XX (Health Services Management). Squadron Commanders are flight nurses, and are supported by a Chief Flight Nurse, an Operations Officer, and a Standardization and Evaluation program.

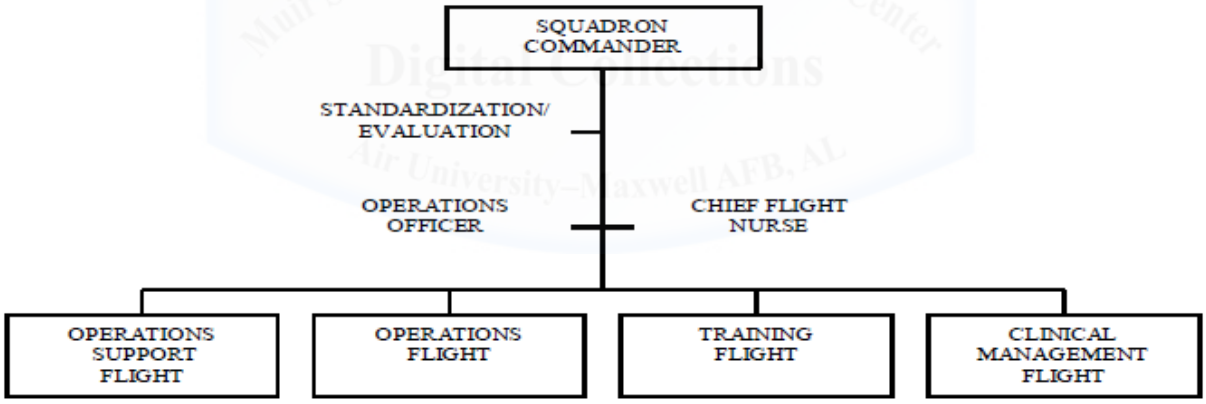

Figure 2 Operations Squadron Structure for Aeromedical Evacuation Squadrons. *Reprinted from Air Force Instruction (AFI) 38-101. Manpower and Organization, 16 March 2011, 31.*

AFI 38-101 also describes the roles and responsibilities of each flight. The Operations Support Flight contains the majority of Airmen belonging to the Health Services Management career field. A Health Services Administrator is also common, and this officer may be the

flight's commander. Flight members fill non-clinical positions, and provide "C4 systems, logistics, resource management, and readiness support."[22]

Operations Flight personnel also perform non-clinical roles. This flight requires the most manpower, and is typically staffed with novice clinicians. Personnel provide "scheduling, mission planning, and mission management for operational and aeromedical readiness missions."[23] It also "Coordinates pre-mission requirements with supporting agencies, provides ground support during execution of AE missions for assigned and transient AE crews/Critical Care Air Transport Teams, and processes all required post-mission documentation."[24]

The Training Flight is "Responsible for the aircrew and ground UTC training requirements of all assigned personnel."[25] These instructors teach operational and clinical knowledge. Operational knowledge entails actions that safely facilitate using the patient care platform. Clinical knowledge pertains to healthcare. Only operational missions allow patient interactions.

The Clinical Management Flight has the greatest clinical orientation. Those assigned are "Responsible for the clinical training, patient safety, and clinical quality programs."[26] They must ensure AES personnel meet AE standards and clinical competencies. The flight schedules crewmembers for certification renewal courses, and conducts in-services to maintain clinical knowledge. Despite a clinical focus, additional patient care opportunities are not provided.

There are currently 18 Air Force Reserve Command, 9 Air National Guard, and 4 active duty AESs.[27] The two stateside active duty squadrons are located at Scott Air Force Base, Illinois and Pope Field, North Carolina. They are designated the 375 and 43 AES, respectively. The 43 AES is currently relocating to Travis Air Force Base, California. The 18 AES is located at Kadena Air Base, Japan, and the 86 AES is located at Ramstein Air Base, Germany.

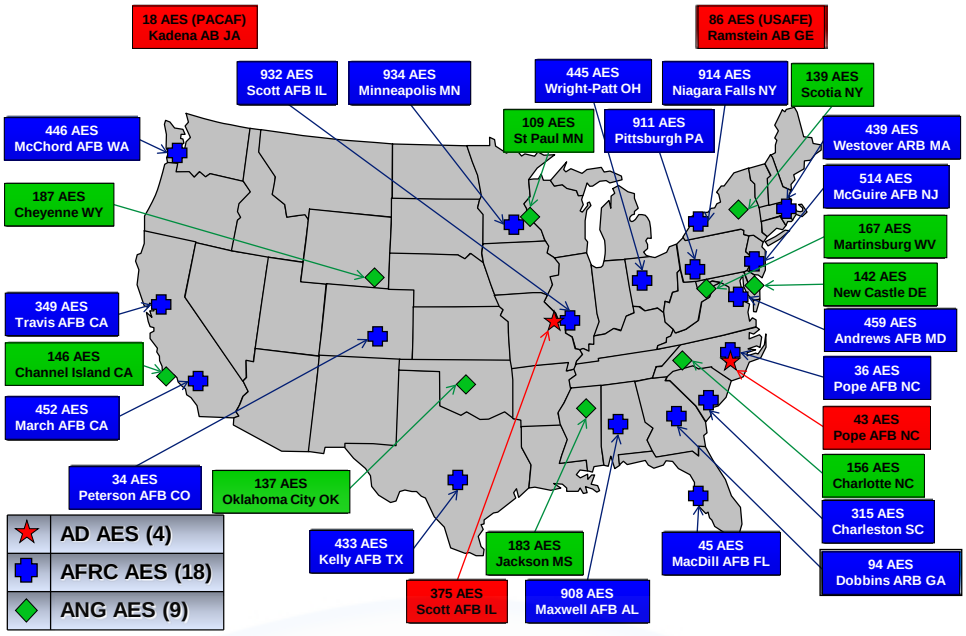

Figure 3 Aeromedical Evacuation Squadrons. *Reprinted from Briefing Slides, Aeromedical Evacuation Mission Support & Contingency Operations Branch, Tanker Airlift Control Center*

Initial Training Requirements

Nurses must accomplish prerequisites to enter the AE career field. A Chief Nurse must recommend candidates and ensure eligibility. At a minimum, applicants must be First Lieutenants and have had two years of nursing experience. One year of inpatient care is preferred, but not required. Applicants must also possess a Secret clearance, be eligible to deploy, and meet Air Force fitness standards. Following the Chief Nurse's approval, candidates must schedule an Initial Flying Class III physical to ensure physical capability.[28] Applicants then await AES placement.

Following assignment notification, nurses must attend a survival, evasion, resistance, and escape course. The United States Air Force School of Aerospace Medicine's flight nursing course must also be accomplished. Graduates then proceed to the AE Formal Training Unit, and

upon successful completion, are sent to their assigned AES to finish initial qualification training.[29]

To become mission-ready, flight nurses must then complete Mission Qualification Training. This consists of 12 ground training requirements. One item is clinically focused. This item ensures knowledge of the Health Information Portability and Accountability Act.[30]

Maintaining Currency

To remain mission-ready, flight nurses must regularly re-accomplish training. Ground training and flying requirements are included. There are 21 ground training items. Eight have a clinical focus. These include: Cardiopulmonary resuscitation, Advanced Cardiac Life Support, hands on medical equipment review, Health Information Portability and Accountability Act, medication administration, burn trauma, pain management, and psychiatric management. Cardiopulmonary resuscitation and Advanced Cardiac Life Support are renewed via classroom instruction every two years. Health Information Portability and Accountability Act and medication administration items must be completed annually using computer based training platforms. The remaining items must be accomplished every six months, and "May be credited through in-service training, operational missions, an ARM [aeromedical readiness mission], or a static training mission."[31]

Most flying requirements must be re-accomplished on a semi-annual basis. Several training platforms exist. Training items performed on operational missions can be credited. Remaining items can be accomplished on an aeromedical readiness mission. If an aeromedical training mission cannot be scheduled, training can be accomplished using an aircraft that remains on the ground. When a parked aircraft is used to accomplish required tasks, it is termed a static training mission. A static training mission "may be accomplished in a static aircraft or aircrew

training device to complete continuation flying training events when a flight has been cancelled or the aircraft is unavailable for flight."[32] All flying requirements can be accomplished using a static training mission, however, an actual flight is mandated every sixty days to maintain currency. Static training missions fail to prepare crewmembers for working conditions experienced during flight. An actual flight is mandated every sixty days to maintain currency. There are a total of 21 flying requirements. Nine are clinically focused, and 12 are focused on aircraft operations.[33]

PROBLEM

The AE system is operationally focused. The operational components of AE are important, and without proper training, transporting patients on aircraft would be unsafe. However, operational safety cannot come at the expense of clinical safety. Excellence in both components must be pursued. The current imbalance causes several problems. These include limited patient care opportunities, rudimentary clinical training, and a diverse patient population cared for by inexperienced flight nurses. These problems have ethical implications that justify change.

Limited Patient Care Opportunities

Opportunities to participate in operational missions are limited. This prevents maintaining clinical skills. The Air Force Reserve Command and Air National Guard fly 80 percent of all operational missions.[34] They also have the advantage of practicing medicine in civilian hospitals when not on active orders. Active duty flight nurses participate in the remaining 20 percent of operational missions. When they are not providing in-flight care, they are engaged in additional duties to maintain the AES. Crew members are either scheduled for a planned mission, or alerted for a mission while participating in a Standby Force.

Not all command and control agencies maintain a Standby Force. Currently, only deployed flight nurses, and those stationed at the 18 and 86 AES are tasked. A Standby Force ensures crewmembers are prepared to rapidly respond. A squadron commander "may keep an aircrew in ALPHA and BRAVO status up to 48 hours."[35] These postures allow launch within one or three hours, respectively.[36] This expedites high priority patient movements. It also increases the frequency of operational missions, which provides additional patient care opportunities. The 375 and 43 AES are not tasked to provide a Standby Force because stateside civilian air ambulances offer transports at lower costs.

Figure 4 Patient Movement Visibility. *Reprinted from Briefing Slides, 18 Air Force AE Story, Aeromedical Evacuation Division, Tanker Airlift Control Center.*

Air Mobility Command provides command and control for strategic AE missions. Strategic AE is, "The phase of medical evacuation that provides air transport for patients from

medical treatment facilities within the area of operations to medical treatment facilities outside the area of operations, or between medical treatment facilities outside the area of operations."[37] These flights are classified as channel missions, and evacuate patients along prescribed routes on a reoccurring basis. Deployed personnel are responsible for the majority of these missions. Naturally, this affords a large portion of operational missions to only deployed personnel.

Remaining channels are crewed by stateside personnel. AESs compete to crew a weekly channel in the Pacific and three biweekly channels within the United States. The tasked AES must provide a basic crew. "A basic AE crew consists of two FNs [flight nurses] and three AETs [aeromedical evacuation technicians]."[38] Only the Chief Flight Nurse can adjust the crew complement. As an example, "an additional FN [flight nurse] and AET [aeromedical evacuation technician] may be added for large patient loads or two additional FNs [flight nurses] may be added to assist with increased medication administration requirements."[39] Currently, peacetime requirements rarely justify seven crewmembers. Therefore, out of 29 squadrons, seven are tasked on a weekly basis to provide two nurses for operational missions.

Rudimentary Clinical Training

With such limited opportunities to participate in operational missions, other means to maintain currency must be provided. The preferred method is to schedule an aeromedical readiness mission. This option offers the most realistic training and helps crewmembers develop time management skills. Those assigned to the mission must receive a mock patient report, transport equipment to the plane, configure the cabin for flight, and load simulated patients in time for the scheduled departure. This option also prepares crewmembers to work in an environment with significant noise, vibrations, and temperature variations. Finally, it allows crewmembers to practice safely loading and unloading patients while the aircraft engines are

running. When an aeromedical readiness mission cannot be facilitated, a static training mission must suffice.

AE depends on other units to provide flights. These units have training requirements of their own. Additionally, maintenance must be scheduled to ensure aircraft availability. AE currency requirements that mandate flights every sixty days can quickly tax the system. Prior to establishing the Formal Training Unit, initial trainees were failing to meet Air Force mandated qualification deadlines.[40] "System factors that contributed to the long qualification process included limited aircraft availability for training missions, fewer routine AE missions within the United States, nonstandardized or redundant training at the unit level, and duty schedule complexity for National Guard and Air Force Reserve members."[41] The Formal Training Unit improved matters, but static training missions have not been eliminated.

Regardless of which training platform is used, all clinical situations are simulated. Patient care is practiced on low fidelity manikins, and disease specific training requirements result in repetitive scenarios. Very little research has been conducted to determine the effectiveness of simulated training for transport caregivers.[42] However, concerning results have been discovered for simulation training in general. "It has been demonstrated that paramedic skills in pediatric resuscitations decrease within six months of training in a pediatric resuscitation course."[43] This would suggest that quality training should be mandated biannually at a minimum. Training techniques that have been proven to benefit transport caregivers should also be pursued.

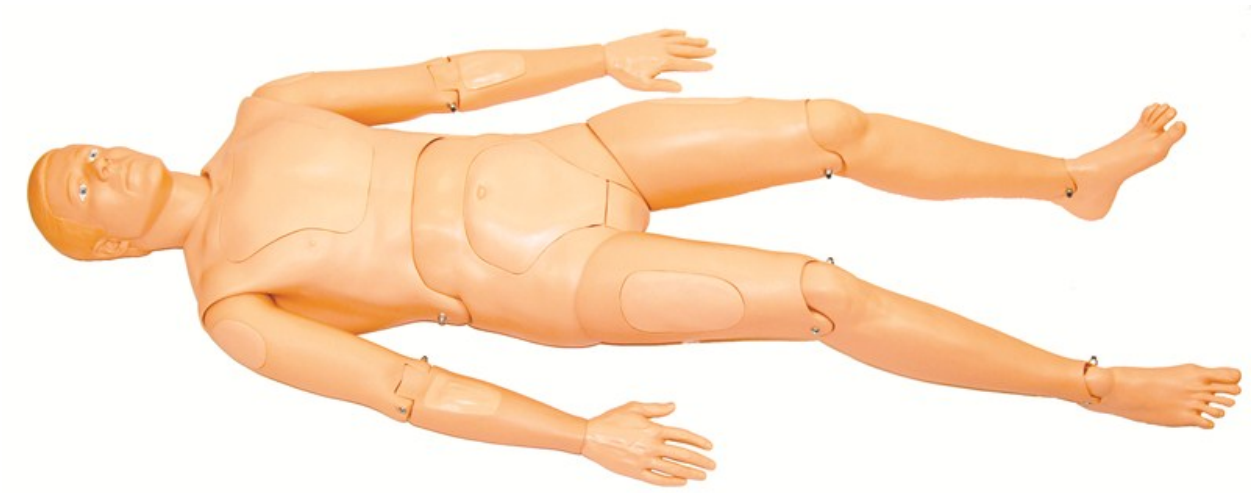

Figure 5 Low Fidelity Manikin. *Reprinted from Laerdal. "Patient Care Manikins: Extri Kelly." Accessed 19 October 2016. http://www.laerdal.com/us/doc/80/Extri-Kelly#/Info.*

Simulation has not been proven to benefit clinicians in all situations. Healthcare providers simulating certain tasks, such as intubation, have shown improvement. Simulations have also enhanced team performance during patient emergencies. However, high fidelity manikins used for these simulations are far superior than what is available to an AES. Little data exists validating the effectiveness of simulation training in AE. In a literature review of 705 sources, only one study addressed the effectiveness of medical flight crew simulation training.[44] Those conducting the review noted significant limitations in the study. They determined, "Little evidence has been reported to support the transferability of skills from the simulation center to the patient bedside."[45] They also posited that the benefits of simulated scenarios might not correlate with flight nurse proficiency. "Simulation has been shown to improve team performance, especially during crises; however, the majority of health care is not provided during a crisis."[46]

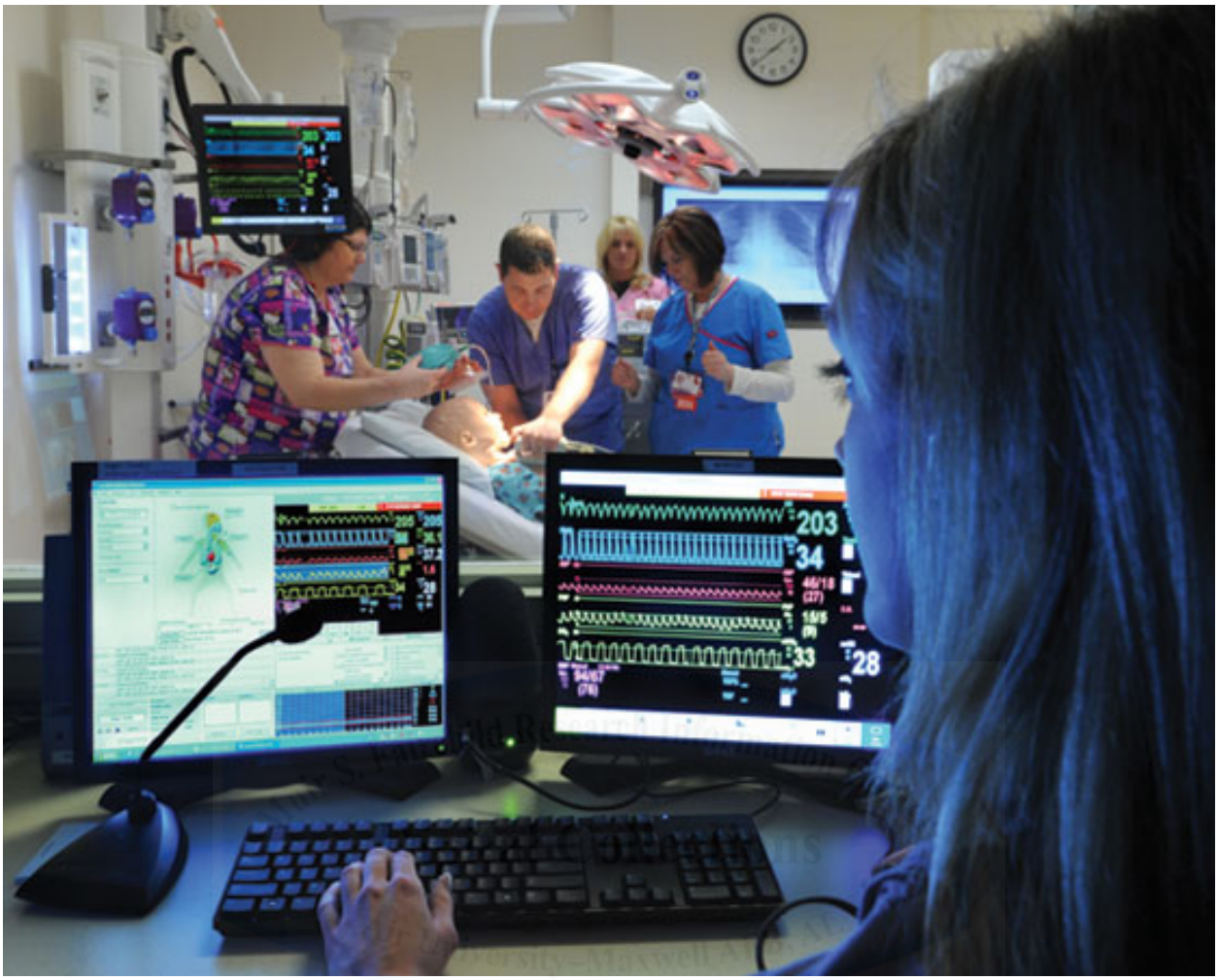

Figure 6 High Fidelity Manikin. *Reprinted from Young, Ashley. "How a Simulation Lab Helps Medical Staff." Technology, 1 October 2012. http://blog.childrens.com/an-inside-view-of-childrens-simulation-lab/.*

Patient Considerations

Despite few opportunities to participate in operational missions, and concerns surrounding training platform efficacy, flight nurses must be prepared to care for patients with an amalgam of diagnoses. This is divergent from most nurses working in hospitals. Hospital units are usually structured to provide care for specific populations. For instance, there may be a medical unit, a surgical unit, a pediatric unit, a telemetry unit, etc. However, flight nurses must possess the clinical expertise to care for every patient requiring transport. Studies have revealed,

"Cardiac, neurologic, orthopedic, surgically remediable, and obstetrical conditions are most likely to benefit from immediate evacuation."[47]

To provide optimal care, clinical competency must be maintained for each specialty. AFI 41-307 provides clinical guidance and describes the AE objective. It states, "The primary goal of AE medical transport is to meet the perceived, actual, or potential health needs of the patient, while maintaining the continuum of care."[48] The AFI highlights how stresses of flight affect various body systems. Stressors include decreased partial pressure of oxygen, barometric pressure changes, thermal changes, decreased humidity, noise, vibration, fatigue, and gravitational forces. Although all conditions benefiting immediate evacuation are covered, clinical acumen derived from experience cannot be replaced by memorizing information contained in a document.

Air Force flight nurses are in a unique position to transport patients who are not ideal candidates. Many war-related conditions require movement, but medical facilities cannot be built near every military operation. Therefore, poor candidates such as those suffering from acute psychosis and uncontrolled seizures, may require movement.[49] Additionally, battle-injured trauma victims may need immediate evacuation. Although these patients would not typically be candidates for AE, life-saving attempts must be made. The North Atlantic Treaty Organization standardization office acknowledges, "Sometimes a calculated risk must be taken."[50]

The First Gulf War demonstrated that many flight nurses were unprepared to assume this risk. In response, the critical care air transport team was created. The team consists of a physician, a critical care nurse, and a cardiopulmonary craftsman.[51] "The CCATT [critical care air transport team] program was founded in 1994 because of the unmet need for evacuation of traumatically injured and critically ill patients for long-range air transport."[52] This capability

contributed to improving efficiency. Movement to definitive care previously took weeks. "Today, the time between injury and arrival in the United States has been reduced to three or four days."[53]

Despite their success, these teams are not a substitute for proficient flight nurses. Manifesting physicians is not unique to the military. A civilian company revealed, "We uniformly include physicians in international evacuation because of the severity of injury or illness in patients we transport and the likelihood of encountering additional medical risks and complications when retrieving a patient."[54] Despite the possibility of an available physician, the professional organization for transport nurses sets standards significantly higher than the Air Force.

Standard of Practice Discrepancies

This professional organization is The Air & Surface Transport Nurses Association (ASTNA). It promotes safety in all aspects of patient transport. "ASTNA, as the professional organization representing transport nurses, defines the qualifications, orientation, competencies, and continuing education necessary for transport nursing."[55] They provide standards for air and ground transports.

ASTNA recommends that hiring flight nurses should be based on: "educational and experiential background, technical and clinical competence, leadership skills, critical thinking skills, proficient communication and interpersonal skills, appreciation of public and community relations."[56] In the Air Force, the Chief Nurse would be comparable to the civilian hiring authority. It would be the Chief Nurse's responsibility to review the applicant's performance reports and obtain feedback from superiors to determine a recommendation.

ASTNA expects flight nurses to successfully complete Basic Life Support and Advanced Cardiac Life Support. Additionally, they require age specific training such as the Neonatal Resuscitation Program, Pediatric Advanced Life Support, etc., if employers transport these demographics. ASTNA also recommends completing the Transport Nurse Advanced Trauma Course and/or Advanced Trauma Life Support.[57] Despite the eligibility of every patient demographic, age specific training is not required by the Air Force. Trauma courses are also not required. Although Air Force flight nurses are not first responders, they do provide care for patients with complex battle injuries and traverse areas of conflict.

Finally, ASTNA requires three years of critical care or emergency department experience. The applicant must possess a certification in one of the respective specialties. Following two years of flight nursing experience the employee is expected to obtain a Certified Flight Registered Nurse accreditation.[58] In contrast, the military requires two years nursing experience, with inpatient experience preferred. Nurses are not required to hold specialty certifications as prerequisites, and are not expected to become a Certified Flight Registered Nurse. The discrepancies between Air Force and ASTNA standards are outlined in Figure 7.

		Organizational Standards	
		ASTNA	Air Force
Clinical Requirements	Basic Life Support	✓	✓
	Advanced Cardiac Life Support	✓	✓
	Age Specific Certifications	✓	
	Trauma Certification	✓	
	Critical Care/Emergency Nursing Experience	✓	
	Critical Care/Emergency Nursing Certification	✓	
	Flight Nurse Certification	✓	

Figure 7 Clinical Flight Nursing Qualification Criteria.

Ethical Considerations

These divergent sets of standards raise ethical questions. The Secretary of the Air Force publishes Air Force Policy Directives. Directive 46-1 establishes nursing policy. It states, the medical service will "Comply with professional nursing ethics and nursing standards of practice and care."[59] Among various groups and laws, the policy directive specifies compliance with professional nursing organizations.

AFI 46-101 also instructs military nurses to comply with professional nursing organization standards. The AFI states, "The *Code for Nurses* and the Standards of Professional Performance Chapter in the *Standards of Clinical Nursing Practice* published by the ANA [American Nurses Association] form the basis for a competent level of behavior expected of AF Nursing Services personnel."[60]

Code of Ethics for Nurses with Interpretive Statements succeeded *Code for Nurses* in 2015. Provision 3 states, "The nurse promotes, advocates for, and protects the rights, health, and safety of the patient."[61] Interpretive statement 3.3 expounds on the provision. It explains that educators must ensure "that basic competence and commitment to professional standards exist prior to entry into practice."[62] It further states, "Nurse managers and executives must ensure that nurses have the knowledge, skills, and dispositions to perform professional responsibilities that require preparation beyond the basic academic programs."[63]

Provision 4 states, "The nurse has authority, accountability, and responsibility for nursing practice; makes decisions; and takes action consistent with the obligation to promote health and to provide optimal care."[64] Interpretive statement 4.1 specifically includes administrative nurses. Nurses have authority within their hired or appointed role. Any administrator in a position of influence is obligated and responsible for the nursing care and regulations under their purview.[65]

Provision 7 states, “The nurse, in all roles and settings, advances the profession through research and scholarly inquiry, professional standards development, and the generation of both nursing and health policy.”[66] Interpretive statement 7.2 commissions executives to advocate for their profession. Not only do nurses have a professional obligation to do so, but also an ethical one.[67] “Nurse executives establish, maintain, and promote conditions of employment that enable nurses to practice according to accepted standards.”[68]

The code of ethics presented by the American Nurses Association is formally espoused by the Air Force. This obligates military leaders to enforce its standards. The Air Force must also meet ASTNA prerequisites and standards. The code of ethics commissions nurse executives to demand the best care possible. With limited opportunities for maintaining clinical skills, and questionable training efficacy, Air Force executives would find difficulty guaranteeing that flight nurses are delivering optimal care. Finally, the embraced code of ethics charges nurses to advocate for their profession by developing improved practices and standards of care. Three options for improving the AE system are discussed, and the measures used to evaluate the options are presented below.

MEASURES

When considering alternatives, measurable criteria are necessary to determine the ideal solution. The goal is to seek a change that improves the clinical proficiency of flight nurses and ensures competence in all aspects of patient care. Professional nursing organizations have established minimum standards to ensure a baseline competency. These are based on research, laws, ethics, and professional expertise. At a minimum, all organizations should enforce current standards.

Enforcing flight-nursing prerequisites is not enough to ensure competency. Clinical proficiency must be maintained. Skills must be practiced to remain honed. Therefore, the first measure of an ideal solution evaluates increased opportunities for clinical practice.

An ideal solution must also be feasible. It must be able to be supported operationally. To be a viable solution, existing infrastructure should be utilized. Required resources to facilitate the change must be considered. Therefore, the second measure evaluates operational impact.

A solution should also be cost effective. Budgetary constraints exist, and exorbitant change may not be feasible in the current fiscal environment. Therefore, the final measure explores cost considerations associated with the proposed change.

ALTERNATIVES

These measures will be used to outline three viable alternatives to improve the AE system. The three alternatives include improving the simulation environment, initiating a clinical rotation program, and attaching flight nurses to the medical group. The ideal alternative would be an affordable solution that balanced time spent on operational and clinical duties.

Improved Simulation Environment

One option would be the development of a more realistic training environment. Advancements in technology have vastly improved the health professions. Education and training departments have also benefited. Medical manikins have evolved from simple props to complex interactive teaching aids. These manikins provide visual, audio, and tactile feedback. Virtual clinical simulation (VCS) technology is another resource educators are experimenting with. "Also known as three-dimensional virtual worlds, serious gaming, or massively multiplayer virtual worlds, VCS involves students using avatars to navigate within an environment."[69]

Air Force executives are actively considering ways to improve training. Simulation technology appears attractive to AE leadership. According to the En Route Medical Care Division Chief for the Air Mobility Command Surgeon General, "Our number one priority is incorporating simulation into our clinical training requirements."[70] The Surgeon General's chief of AE clinical training shares this vision, and hopes to see the development of clinical training centers. He explains, "The research lab is looking at using virtual environments, gaming and personalized training to keep AE members proficient."[71]

Patient Care Analysis

Although the option seems fascinating, it fails to provide additional patient interactions. Similarly to the unproven efficacy of simulation training in the AE environment, VCS is also an unproven method. A literature review in *Clinical Simulation in Nursing* found that additional research is needed to demonstrate its value in nursing education. The authors determined, "At this time, the body of research is slim, and thus, one cannot make a strong endorsement for or against VCS."[72]

Clinical training centers may be a good training adjunct, but they would not be a viable replacement for patient interactions. Research studying the reintegration of nurses following deployments found that painful memories were a significant trend. The study recalls the account of a flight nurse:

> I think I had not really prepared myself for the type of trauma that I saw in Iraq. Even though I'm a trauma nurse, I had not prepared myself for all the burns, traumatic amputations, and the youth of the patients. So, when I first came back, I had a very hard time. There was a lot of burnout for me. I was just very angry about a lot of things.[73]

It is unlikely that simulated scenarios can adequately prepare nurses for these types of clinical experiences. Air Force flight nurses are particularly vulnerable to these types of interactions because they care for injured patients during war.

Impact on Operations

Clinical training centers would have a negligible impact on operations. No requirements to change the current system can be foreseen. Nurses participating in training would be absent from the squadron. Additional duties would require delegation to qualified personnel, or they would wait until the nurse's return. Time away would depend on the number, and location, of training centers. If every AES were located near a training center, nurses would likely be absent no less than a week. If travel to a temporary duty location were necessary, nurses would likely be absent no less than two weeks. Other potential impacts include decreasing the availability of other temporary duty opportunities, and limiting leave request authorizations.

Cost Considerations

Building training centers would be an expensive endeavor. The University of South Florida invested in a training center providing capabilities similar to what Air Mobility Command leaders are advocating. The Tampa Bay Tribune reported, "The 90,000-square-foot, $38 million center was designed to train health professionals on the latest in simulation technology."[74] Costs would vary depending on the size and number of centers pursued by the Air Force. High fidelity manikins can cost up to $250,000 each.[75] Low fidelity manikins, like the one pictured above, is advertised at $1,410.[76] The prices of manikins alone would incur a significant cost, and these would likely be only one feature of a clinical training center.

Clinical Rotation Program

A second option would be the development of a clinical rotation program. This would allow flight nurses to rotate through various beneficial settings. Ideally, trauma centers and hospitals with critical care units would be utilized. The Air Force currently has medical treatment facilities with these capabilities. Many have critical care units, and the San Antonio Military Medical Center provides emergency trauma services. This is a unique capability that prepares medical personnel for wartime injuries. Flight nurses could greatly benefit by providing care in such rich learning environments that are already under military management.

Programs that partner with civilian hospitals are another option. Partnerships to prepare military members for deployment are already in place. The Air Force currently utilizes the C-STARS (Center for Sustainment of Trauma and Readiness Skills) program to prepare Airmen for upcoming deployments. "C-STARS is the first program in the country to prepare U.S. Air Force medical technicians, nurses and doctors to take care of traumatic injuries to patients during war time."[77] The program is currently offered at three locations. The Baltimore location offers extensive hands-on trauma care. The Saint Louis location focuses on preparing Airmen to operate in an EMEDS-basic, and the Cincinnati location is tailored to the critical care transport team. "Any and all CCAT [critical care air transport] Team members will attend CCATT Sustainment training at C-STARS Cincinnati."[78] In addition to preparing Airmen for deployment, this program could also be used to maintain the proficiency of flight nurses.

Patient Care Analysis

Unlike clinical training centers, this option would provide additional patient care opportunities. Working at medical treatment facilities, providing care for significantly ill or injured patients, would greatly contribute to maintaining clinical proficiency. Basic skills such

as patient assessments, medication administration, and phlebotomy could be practiced. Experience gained caring for trauma victims would prepare nurses to care for significant battle injuries, patients requiring resuscitation, and potential injuries following an aircraft emergency.

While attending the Baltimore C-STARS program, a technical sergeant was interviewed. He stated, "We're not only refreshing our skills, we're also getting the confidence to apply those skills,"[79] Participation in this type of program would prepare flight nurses clinically and mentally.

Impact on Operations

A clinical rotation program would minimally affect operations. The structure of the AES and AE system could remain in their current state. This option would also result in a short absence of flight nurses. The squadron impact of participating in clinical rotations would be identical to attending clinical training centers. It would be reasonable to assume that this type of clinical rotation would be a similar duration as the programs to prepare Airmen for deployment. Currently, nurses attending the C-STARS program are enrolled for two to three weeks. The St. Louis and Cincinnati programs are two weeks, and the Baltimore program is three weeks.

Cost Considerations

This option would incur a moderate cost. Military medical treatment facilities constitute an inherent training platform. If partnering with civilian hospitals was preferred, appropriate programs are already in place. Accommodating additional participants could require programs to expand and incur additional costs. Remaining foreseeable costs include enrollment, and those associated with travel, lodging, and subsistence for attendees.

Attach Crewmembers to the Medical Group

A third option is to attach AE crewmembers to medical groups. As previously discussed, medical treatment facilities with the means to provide flight nurses with valuable experience already exist. This structure currently supports critical care air transport teams. These medical personnel primarily work in hospitals. When their expertise is needed in flight, they are excused from their assigned unit. Team members are manifested as attendants and do not require the amount of training AE crewmembers must maintain. These teams are manifested on some missions, but AE crewmembers are manifested on all missions. If flight nurses assumed this posture, they would be absent from the bedside more frequently.

Innovative soldiers have advocated a similar solution to overcome challenges with medical evacuation crew competence. Medical evacuation is the transport of patients on helicopters. Medical evacuation units have traditionally been crewed by Soldiers holding an Emergency Medical Technician-Basic certification. Multiple factors have necessitated an increased level of clinical expertise in helicopter crewmembers.[80] To remedy this situation the Army is now requiring a paramedic license for all crewmembers.[81]

However, some Army nurses disagree with this solution. Their dissent is derived from an inability to ensure proficiency. They believe that nurses who split their time between the medical evacuation unit and the hospital would be a better solution. Paramedics and flight nurses are plagued with similar limitations. Paramedics graduating from Army schools lack experience, and they would not be afforded the clinical exposure to develop skills prior to deployments. This lack of experience would disqualify them from meeting civilian hiring standards. By contrast, “For nurses, daily clinical exposure is the norm, rather than the exception.”[82]

Patient Care Analysis

This option would significantly increase clinical exposure. Instead of two or three weeks of quality clinical experience, crew members would split their time between clinical practice and operational duties. To maximize efficiency, the posture assumed by critical care air transport team members could be modified for flight nurses. One possibility is the formation of a float staff. This would be a valuable resource to the medical treatment facility. It would also eliminate the possibility of leaving units undermanned when flight nurses were absent due to AE requirements. Float staff could fill vacancies left by Airmen on quarters, taking leave, or absent due to temporary duty requirements and deployments. Higher acuity units could be prioritized to receive float staff. This would provide crewmembers with optimal clinical exposure. When required, flight nurses would participate in operational missions, aeromedical readiness missions, and Standby Force duty.

Impact on Operations

This option would result in significant change to the AE system. With crewmembers splitting their time between clinical and operational duties, fewer personnel would be available to maintain the squadron. Fortunately, many of the additional duties assigned to crewmembers in the AES are replicated in the medical treatment facility. This redundancy could be absorbed by hospital employees. Every Clinical Management flight role could be absorbed, along with most Operations Support flight positions. This consolidation could justify the AES becoming a flight. As a flight, the unit could eliminate many leadership roles. A squadron commander, a first shirt, a superintendent, and a chief flight nurse would no longer be necessary.

The newly established flight could be attached to either the Aerospace Medicine squadron or the Medical Operations squadron. This flight would require an operations officer, a

standardization/evaluation program, and elements to complete duties currently performed by the operations flight and training flight. Some crewmembers with operational knowledge could be required to fill these positions. However, the majority of roles can be assigned to Health Services Administrators and Health Services Management enlisted personnel.

Cost Considerations

Assessing the cost of this option is difficult. When the 43 AES relocates to Travis Air Force Base, the majority of squadrons will be near large medical treatment facilities. The 18 and 375 AES are exceptions. The 18 AES would have to move to Hawaii to be near Tripler Army Medical Center. However, to facilitate a theater Standby Force, aircraft would require positioning nearby. This could dictate additional unit relocations, or result in increased jet fuel consumption. The 375 AES would have to relocate to another base within the continental United States. A base that possessed a large medical treatment facility, and provided aircraft to facilitate operational training requirements would be optimal.

Currently, the 375 AES does not possess a local training platform. Justification to relocate the unit could arguably be based on this alone. Crewmembers commonly partner with the 43 AES to accomplish aeromedical readiness mission requirements. Flying from Pope Field to Scott Air Force Base incurs additional C-130 operating costs. It also necessitates costs associated with off-station temporary duty assignments for all aircraft crewmembers. This partnership will likely be unjustifiable following the relocation of the 43 AES.

This option would result in many changes. Some changes should decrease operational costs. More efficient use of nursing resources, and eliminating redundant positions, would have financial benefits. However, facilitating the change would require an initial investment. Additional research would be required to accurately predict the price of the proposed change, but

it is fair to say a moderate cost would be incurred initially. Long-term operational costs would likely decrease.

ANALYSIS

All three options are improvements from current practices. Attaching flight nurses to the medical group would result in greater opportunities for maintaining nursing skills. This option allows flight nurses to apply their clinical knowledge on a regular basis. By implementing this change, operational readiness would be closely balanced with clinical readiness.

Clinical rotations would increase clinical practice to some degree. However, to maintain squadron requirements, not every flight nurse could attend simultaneously. Opportunities to participate in clinical rotations would likely be limited to once or twice a year. Studies have shown that benefits gleaned from refresher training tend to dissipate over time. This option fails to balance the operational focus and may have limited efficacy.

Concerns over simulation training also exist. Research has thus far been unable to guarantee increased nursing proficiency as a result of high fidelity simulation training. Air Force leaders appear aware of these limitations. Recently, the Air Mobility Command Surgeon General led a focus group to assess AE clinical sustainment training. "The results identified research is needed on the use and effectiveness of simulation in clinical training."[83] In addition to these concerns, this option would not provide any additional opportunities to care for patients.

Improved simulation training and implementing clinical rotations would have a minimal impact on operations. Alternately, attaching flight nurses to the med group would have a significant operational impact. The degree of change required to implement the various options should not be viewed in positive or negative terms. Instead, change should be viewed logistically, and those with the authority to implement change should be cognizant that many

people resent change. Understanding this might help leaders mitigate bias. An increased operational impact simply implies that more time and analysis will be required for implementation.

Improved simulation training via clinical training centers would likely incur the greatest cost. Providing flight nurses with clinical rotations and attaching flight nurses to the medical group would probably cost less. Because leaders within Air Mobility Command have publicized a desire to develop clinical training centers, options that cost less would logically be viable.

In light of this comparison, attaching flight nurses to the medical group is the recommended solution. This provides the best opportunities to maintain clinical skills and proficiency. This option also appears financially feasible. Although it will result in the most operational impacts, this simply implies that greater time and further analysis will be required for implementation.

RECOMMENDATIONS

Nurse Corps leaders should consider the possibility of downsizing the AES to an AE flight and attaching it to a Medical Group squadron. Many AE executives may initially balk at the suggestion. The idea may cause some to fear losing leadership positions and opportunities for command. However, modifying the system to improve the quality of patient care is warranted. For years, the Nurse Corps has been advocating a clinical career track that allows high-ranking nurses to remain in the clinical environment. By downsizing the AE squadron to a flight, positions for Lieutenant Colonels and Colonels could be allocated to the medical group to fill nurse practitioner or clinical nurse specialist roles. A strategic perspective would allow visionaries to see that this solution could improve healthcare and allow high-ranking officers to utilize their expertise while remaining in a clinical setting.

A focus group should be created to investigate the best location for stateside AE flights. Military treatment facilities with the greatest capabilities should be chosen. Operational considerations must also be evaluated. Organizations with AE compatible aircraft should be nearby. This would facilitate completion of all required operational training items. Planners should also take into account system efficiency. Ideally, flights would be positioned near channel hubs. This would place crews near airfields where enplaning and deplaning patients frequently occur.

A second focus group would be required to plan the integration of flight nurses and aeromedical evacuation technicians with medical treatment facility employees. Determining locations and accurate manpower for the newly established flight, preparing units for a float staff, planning hospital orientations, determining how to assign the float staff, and preparing clinical management personnel to absorb the influx are some details that would require preparation.

The data obtained by these groups would allow a thorough cost analysis of the reorganization. Understanding fiscal requirements would facilitate establishing a timeline. Depending on budgetary constraints, changes could be enacted in various stages.

This data would provide a blueprint for implementing the needed changes. The planning to enable a smooth transition would be time consuming and incur a cost. However, such reorganization would provide healthcare that was more effective and efficient.

CONCLUSION

When clinicians are not achieving qualifications recommended by their professional organizations, and opportunities to maintain clinical proficiency are limited, an increased risk for patient harm exists. The military aeromedical evacuation system is presently afflicted by these

conditions. They result from an operationally focused career field. The imbalance between operational and clinical duties has developed as a result of culture and organizational structure. Air Force leaders must raise minimum flight nursing qualifications and increase opportunities to maintain clinical experience. Attaching flight nurses to the medical group will guarantee the best clinical experience and provide the best preparation for operational missions and deployments. Defenders of our nation deserve optimal medical care, and nursing leaders have an ethical obligation to provide it. The American Nurses Association clearly holds all nurses accountable for providing the highest quality of care possible. The Air Force concurs. AFI 46-101 states, "The primary goal of Nursing Services is the delivery of the highest quality of competent, compassionate, efficient, evidence-based and cost-effective nursing care to individuals, families, groups, and communities in support of home station and global medical operations."[84] Of course, some may argue that the military AE system is better than it has ever been, and therefore, does not require change. However, when military standards fail to equal those of our civilian counterparts, Air Force leaders must exemplify their espoused core values and pursue excellence in all we do.

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